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(54) References Cited: JP-B 43-19108
JP-B 47-14767
JP-B 47-6049
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(57) Claims

(1) A method for developing crimps in a bicomponent filament composed of polyethylene terephthalate as one component and polytetramethylene terephthalate or polytrimethylene terephthalate as the other component, the method being comprised of heat-treating the bicomponent filament at a temperature of 150 to 310°C while subjecting the filament to a tension of 0.2 to 1.0 gram per denier.

Detailed Description of the Invention

The present invention relates to a method for crimping bicomponent yarn.

The production of crimped filament having spiral crimps by relaxation heat-treating a bicomponent filament produced by bicomponent spinning two different polyester polymers is well-known.

However, although there are many conceivable methods for carrying out continuous heat treatment on filament in a relaxed state, numerous problems are encountered when such treatment is actually carried out. If the filament is treated in a relaxed state, the tension applied to the yarn during treatment is important. This tension must be kept low. When the tension rises, the crimpability of the filament being treated generally declines. Accordingly, continuous treatment in which the filament is subjected to changes in tension leads to the formation of crimping irregularities in the crimped filament, as well as to non-uniform denier and uneven dyeing. Hence, achieving continuous crimp development at a low tension is a challenge.

In light of these circumstances, extensive research was carried out in order to devise a method for obtaining crimped filament having good filament uniformity and crimp regularity by continuous treatment. As a result of these investigations, it was discovered that when the tension applied during heat treatment to a strand of bicomponent filament composed of a specific combination of polyesters falls within a certain range of values, good crimps develop, and that crimped filament which satisfies the foregoing requirements can be obtained. This discovery led to the present invention.

Accordingly, the present invention provides a method for developing crimps in a bicomponent filament composed of polyethylene terephthalate as one component and polytetramethylene terephthalate or polytrimethylene terephthalate as the other component, the method being comprised of heat-treating the bicomponent filament at a

temperature of 150 to 310°C while subjecting the filament to a tension of 0.2 to 1.0 gram per denier.

The bicomponent polyester filament used in the invention is a combination of polyethylene terephthalate with polytetramethylene terephthalate or polytrimethylene terephthalate.

"Polytetramethylene terephthalate," as used herein, refers to a polyester in which at least 80 mol %, and preferably at least 90 mol %, of the recurring units are tetramethylene terephthalate. Illustrative examples of third components that may be copolymerized in a ratio of up to 20 mol % include dibasic acids such as isophthalic acid, phthalic acid, methylterephthalic acid, hexahydroterephthalic acid, naphthlenedicarboxylic acid, diphenyldicarboxylic acid, sebacic acid and adipic acid; glycols such as neopentyl glycol, trimethylene glycol, hexamethylene glycol, 1,4-cyclohexanedimethanol, 1,4-bishydroxybenzene and bisphenol A; and oxycarboxylic acids such as glycolic acid and p-oxybenzoic acid; and functional derivatives thereof.

"Polyethylene terephthalate," as used herein, refers to a polyester in which at least 80 mol %, and preferably at least 90 mol %, of the recurring units are ethylene terephthalate. Examples of third components which may be copolymerized in a ratio of up to 20 mol % include the above-mentioned dibasic acids, glycols, and oxycarboxylic acids.

"Polytrimethylene terephthalate," as used herein, refers to a polyester in which at least 80 mol %, and preferably at least 90 mol %, of the recurring units are trimethylene terephthalate. Examples of third components which may be copolymerized in a ratio of up to 20 mol % include the above-mentioned dibasic acids, glycols and oxycarboxylic acids.

These polytetramethylene terephthalate, polytrimethylene terephthalate and polyethylene terephthalate may include also degree of polymerization adjusters, stabilizers, delusterants, colorants, and other additives.

Production of the bicomponent fibers may be carried out using a bicomponent fiber spinning machine known to the prior art and under ordinary conditions.. The form of conjugation may be side-by-side or eccentric sheath-core. Any suitable polyester conjugation ratio may be selected, although a ratio within a range of 20:80 to 80:20 is generally preferred.

When this conjugated filament is drawn, crimps develop simply upon relaxation of the filament. However, such crimping is insufficient.

Hence, in the present invention, this conjugated filament is heat treated under a tension of 0.2 to 1.0 g/de and at a temperature of from 150 to 320°C, and preferably 150°C to 230°C. In this way, there is obtained a good crimped yarn free of yarn unevenness and irregular crimping.

The crimp development properties of this conjugated filament are shown in FIG. 1. This is a graph of the apparent crimping ratio (vertical axis) of a strand that has been heat treated for 1 minute under the tension shown on the horizontal axis in 180°C air. Crimping develops well under low tension, but at a tension of 2 mg/de or less, it becomes very difficult to obtain crimped yarn having good yarn evenness and crimp regularity by continuous heat treatment at a low tension such as this. Moreover, good crimping is not achieved within a range in tension of 2 to 100 mg/de, whereas good crimps develop when

the tension rises to 200 mg/de or more. However, at a tension greater than 1.0 g/de, crimp development declines once again, in addition to which undesirable effects such as the formation of fuzz during treatment on account of excessive tension makes continuous treatment difficult to carry out. In the invention, the conjugated filament is heat treated under the above-indicated tension at 150-350°C, although a high temperature is desirable when the heat treatment time is short. A heat treatment time of at least 0.1 second is preferred because crimpability declines with shorter heat treatment. When heat treatment is carried out at the melting point or a higher temperature, a long treatment time results in fusing and even yarn breakage in extreme cases. Accordingly, it is critical that treatment be carried out over a short period of time. The heat-treating medium may be a gas. Alternatively, heat treatment may be carried out by having the filaments come into contact with a heater.

The inventive method of manufacturing crimped filament differs completely from conventional crimp development methods in that, being a method which involves heat treatment under a high tension, continuous heat treatment is very easy to carry out. Moreover, because there is little irregularity in crimp development, a crimped yarn is obtained having good yarn evenness and crimp regularity. Hence, the inventive method is advantageous for producing crimped yarn. An example of the invention is given below by way of illustration.

Example

Polyethylene terephthalate having an intrinsic viscosity, as measured at 25°C in o-chlorophenol, of 0.64 and polytetramethylene terephthalate having a reduced viscosity ($\eta sp/o$), as measured in o-chlorophenol at 25°C, of 1.55 were bicomponent spun in a side-by-side manner at a ratio of 1:1 to give 480 de/30 f bicomponent filament. The bicomponent filament was drawn at a ratio of 3.2 using a 80°C drawing pin, thereby giving 150-denier filament.

The resulting drawn filament was subjected to crimp development using a slit heater in air, this being done at a speed of 100 m/min and under the conditions shown in Table 1. The apparent crimping ratio as well as evaluation results for fuzz, yarn evenness and crimp regularity for the crimped yarn produced under various conditions are also presented in Table 1.

Evaluation of yarn evenness and crimp regularity for the crimped yarn was carried out by dyeing a woven fabric obtained from the crimped yarn, and inspecting the dyed fabric for the presence of streak-like irregularities (yarn unevenness) and tight spots (irregular crimping).

Those crimped yarns which were free of yarn unevenness, irregular crimping and fuzz, and which had an apparent crimp ratio of at least 12% were rated as acceptable (O).

Table 1

Sample No.	Tension (g/de)	Heat treatment temp. (°C)	Heat treatment time (s)	Apparent crimp ratio (%)	Fuzz	Yarn unevenness	Crimp irregularities	Overall rating
1*	0.5	90	0.6	7	O	no	no	X
2*	"	140	"	10	O	"	"	X
3	"	150	"	14	O	"	"	O
4	"	200	"	17	O	"	"	O
5	"	250	"	18	O	"	"	O
6	"	310	"	19	O	"	"	O
7*	"	350	"	3	X (fused)	yes	yes	X
8	"	250	0.2	16	O	no	no	O
9	"	"	1.1	21	O	no	no	O
10*	0.05	"	0.6	4	O	yes	yes	X
11*	0.15	"	"	8	O	yes	yes	X
12	0.2	"	"	16	O	no	no	O
13	1.0	"	"	20	O	"	no	O
14*	1.3	"	"	15	X	"	yes	X
15*	2.0	"	"	14	X	"	yes	X

*Comparative examples

Brief Description of the Diagrams

FIG. 1 is a graph of tension versus apparent crimping ratio in heat treatment within 180°C air.

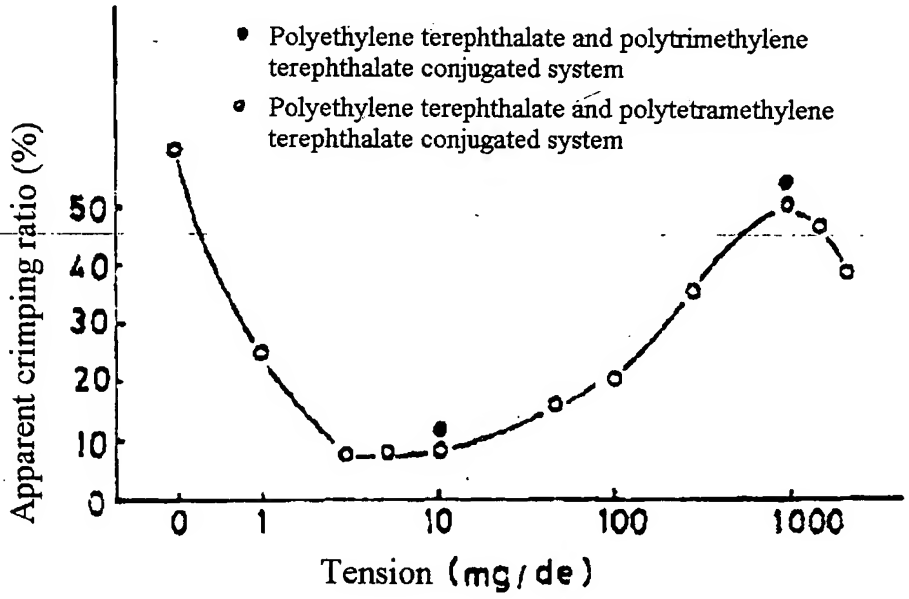

FIG. 1

Transl: Language Services
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